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Research Report

Alberta Agricultural Research Institute • AARI 1997 Issue Two

DAIRY ISSUE !

Improving on a Good Thing

Research responds to changing consumer demand

Milk has long been considered one of nature's perfect foods. But try and tell that to agri-food researchers, who strive for "better-than-perfect." Milk, and other dairy products, have recently been scrutinized by our health-conscious society, which has a much lower tolerance for fat in the total food supply. Researchers have responded to this consumer demand by devising ways in which to improve the fat profile in milk.

Although dairy products (excluding butter) provide only 16% of total fat in the Canadian diet, they provide 30% of saturated fatty acids. This problem provided the basis for two projects supported by the Alberta Agricultural Research Institute (AARI) under its **Farming for the Future Matching Grants Program:**

1) *Altering the Fatty Acid Composition of Milk Fat to Meet Consumer Demand (#93M549)*

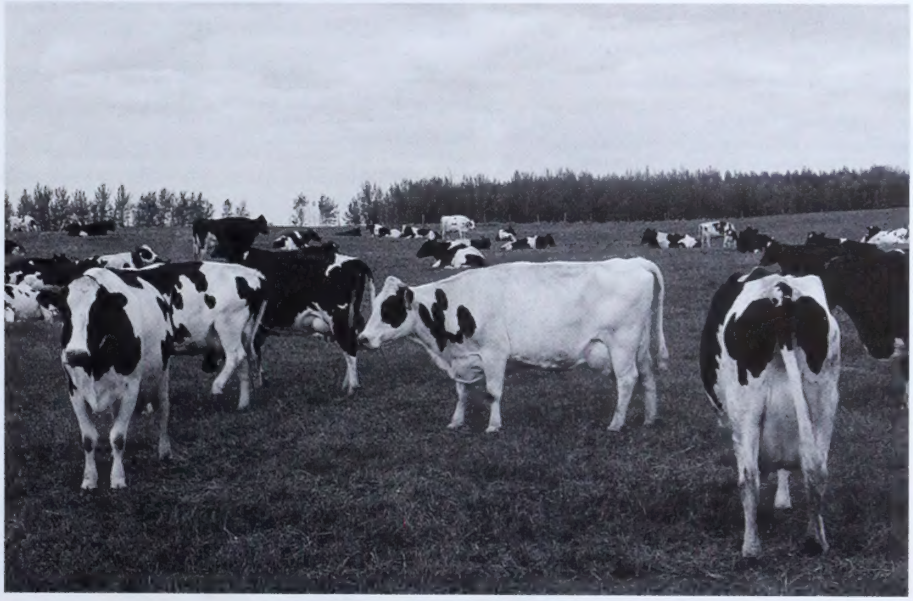
The difference in fatty acid composition between 'ideal' milk fat and 'typical' milk fat is substantial. The Wisconsin Milk Marketing Board concluded that ideal milk fat should contain less than 10% polyunsaturated fatty acids (PUFA), up to 8% saturated fatty acids (SFA), and 82% monounsaturated fatty acids (MUFA). However, typical milk fat from a dairy cow is approximately 5% PUFA, **70% SFA**, and 25% MUFA.

The matching grants research project posed the question whether it is possible, through dietary manipulation of dairy cow diets (particularly through the use of fat supplements, which are resistant to rumen degradation), to modify the fatty acid composition of milk such that the product is more desirable to the consumer. The answer was: yes.

POTENTIAL BENEFIT(S)

More "healthful" milk
- higher consumer demand
- higher milk revenues

(cont'd on page 3)



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On the Farm ...

1) *Alternate feeds for dairy cow diets*

The field pea is the most widely grown pulse crop in Alberta. The feed industry is an excellent potential market for down-grade peas. Compared with soybean or canola meal, peas contain approximately half as much protein. They also contain a high level of starch (54%) and therefore could be a good source of both protein and energy for dairy cows. Two ARI **Farming for the Future On-Farm Demonstration Program** projects attempted to determine the degree of success to which field peas could be incorporated into dairy cow diets.

Both studies have involved more than one producer, in collaboration with Alberta Agriculture, Food and Rural Development staff. In the first project – "Feeding Pea Diets to High-Producing Dairy Cows" (#91-F004-4) – the objective was to determine the effects of substituting peas for a combined soybean and canola meal. The results of the study

suggested that peas can be used in rations for high milk-producing dairy cows. In high-producing dairy cows, the use of untreated peas should be limited only by the cost of providing adequate bypass protein (protein that is not degraded in the rumen).

In the *Canadian Journal of Animal Science*, a paper appeared pertaining to this project: "Effects of Feeding Peas to High-Producing Dairy Cows", R.R. Corbett, E.K. Okine and L.A. Goonewardene. According to Dr. Goonewardene, "For cows in early lactation, 4% fat-corrected milk yield was higher for cows fed pea-based concentrates than for cows fed soybean meal/canola meal supplement. Fat-corrected milk yield was not affected by source of protein in mid- and late-lactation cows. Fat-corrected milk production was not different for cows fed soybean meal/canola meal compared with cows fed the pea supplement when cows across all stages of lactation were included. The results suggest that peas can be substituted for soybean meal/canola meal as a protein source for high-producing dairy cows."

POTENTIAL BENEFIT(S)

- An identifiable market for Alberta-grown field peas.
- Potential replacement of costly imported soy – "as high as 80% in some cases", says Dr. Goonewardene – with locally produced field peas.

2) *Improved milk production with tunnel ventilation in dairy barns*

Poplar Glen Farms Ltd. is a member of the Alberta Dairy Herd Improvement Services. About once a month, milk production from all dairy cows in a herd is determined. These weights are used to calculate the monthly production of an "average" cow in the herd. Poplar Farms noticed a pattern from these records: a midsummer production slump. The cause was heat stress and the answer was tunnel ventilation.

Tunnel ventilation is a simple concept: large openings at one end of the building and large fans at the other. It is gaining popularity in warm climates inside broiler houses, for example. This study – "Dairy Barn Tunnel Ventilation" (#92-F002-4) – concluded that:

- Month-to-month variation in milk production was reduced.
- Changes in management and environmental factors helped reduce milk production variation.
- Tunnel ventilation is suitable for summer. A second system is required for winter.
- Tunnel ventilation is a low-cost method of moving large air volumes through buildings.

POTENTIAL BENEFIT(S)

Increased air movement in dairy barns
- reduced animal stress
- higher milk production.

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Improving on a Good Thing (cont'd)

2) *Gene Expression Screening to Increase Milk Protein Content (#95M737)*

Project manager, Dr. John Kennelly, Professor in the University of Alberta's Department of Animal Science, explains, "The addition of flaxseed to the diet of dairy cows resulted in decreased proportions of saturated fatty acids and substantially elevated concentrations of unsaturated fatty acids in milk; however, flaxseed requires some processing to optimize its effect on the fatty acid composition of milk."

Dr. Kennelly continues, "Canola seed in dairy cows' diets also increases the polyunsaturated fatty acid content of the milk fat; however, like flaxseed, the canola must be treated. In our research, heat treatment and formaldehyde treatment showed positive results."

Interest in exploring the potential to modify the composition of bovine milk is increasing. The researchers' strategy in this area currently involves two different types of studies. One employs a dietary or nutritional approach to modify milk composition. The other uses a genetic approach that focuses on the major milk protein genes. The researchers see future research providing insight into the interactions between diet and genotype (the genetic constitution of an organism, in this case, dairy cows) as the most promising means to achieve precise control of the properties of the future milk supply. Toward that end, this study deals with the theoretical and practical aspects of developing a cost-effective milk protein genotyping procedure for use in current dairy breeding programs.

Project researcher, Dr. Lech Ozimek, explains: "Selective breeding is a realistic approach for the production of milk with enhanced nutritive value or with properties more suitable for the dairy processing sector. Our milk protein allele*-specific detection strategy represents a substantial advance in the simplification of procedures for milk protein genotyping. Regional laboratories dedicated to the new procedure could provide routine identification of milk protein alleles, independent of age and sex. Informed dairy breeders would gain in selection accuracy as a result of this development."

*allele=alternate forms of a gene, which occupy the same relative position on homologous chromosomes.

POTENTIAL BENEFIT(S)

Improved cow milk nutritive composition with the use of genetic identification.

Super Creamers

Improving a successful value-added product with research

Coffee creamers in small plastic cups have been around for quite some time. They have good shelf stability and can even be left at room temperature for a limited time. In comparison to pasteurized dairy products, coffee creamers undergo a more severe form of heat treatment: UHT (ultra-high temperature). Though possessing a reasonable assurance of shelf stability, UHT creamers do spoil and have a low consumer acceptability in North America because of a cooked flavor imparted by the high heat.

High heat treatment of the cream is only the first step on the way to shelf stability. The cream must be filled and packaged under aseptic conditions (free of pathogenic micro-organisms).

Investigations into existing aseptic processing procedures for sterilizing coffee creamers indicated the following problems: high cost of capital equipment, lengthy start-up procedures, extensive down time, and, as mentioned, only reasonable assurance of shelf stability. Aseptic processing techniques sterilize the product and package separately and then create a sterile zone in which to fill and seal the package.

With problems defined, researchers from Alberta Agriculture, Food and Rural Development conducted a Matching Grants Program project, "Post Packaging Single Service Creamer Sterilization" (94M622). The solution was found by filling the product into a laminated, retortable pouch. This type of package provides near instantaneous heating, thus eliminating the cooked flavor.

More importantly, since heat processing occurs after the package is filled and sealed, commercial sterility - the destruction of all vegetative (actively growing) microbial cells – can be achieved with greater assurance.

POTENTIAL BENEFIT(S)

Technological improvement of creamer safety = higher-value product.

Editor's Note: This research exemplified recognition by ARI and the industry for the need to constantly strive for improvement and further value addition of Alberta's agri-food products.

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New Programs for AARI

Value-added technology transfer program

Paul Murphy, chairman of the program review team of the Agriculture and Food Council (AFC), is enthusiastic about the eight programs that received support from the Canadian Adaptation and Rural Development (CARD) fund. Several of the programs will increase innovation in agriculture and food and will provide a source of funds to the industry.

The Alberta Agricultural Research Institute will receive up to $450,000 over the next three years for the Value-Added Technology Transfer Program. The purpose of this AARI program is to financially support projects that speed up the transfer of innovations from research laboratories to new technologies, novel products, innovative processing methods, and sound packaging techniques.

Eligible projects will be funded on a 50:50 cost-shared basis in partnership with industry. **A call for proposals under this program will start August 15, 1997.** For more information, call Dr. Yilma Teklemariam at 403/422-6519.

New value-added corporation announced

On May 28, 1997, Ian Strang, Chairman of the Board of the Agriculture Value-Added Corporation (AVAC), announced that AVAC will challenge the "status quo" of agri-business in Alberta. "New investment must occur if the agri-value-added sector in Alberta is to grow to $20 billion by 2005; in fact, $6 billion in investment! The Province of Alberta has contributed $35 million to AVAC for the purpose of stimulating this growth. AVAC's challenge is to reinvest the funds in research, development and commercialization activities to help facilitate the generation of the required $6 billion in new investment.

Part of ARI's 1996/97 to 1998/99 Business Plan was, "Proposal for an Agricultural Value-Added Processing Research Program." AARI expects to be actively involved in the research component of AVAC.

Also, in keeping with the dairy theme of this issue of "Research Report," it is noted in the AVAC release, under Alberta's Future in Agricultural Products and Services, that to achieve $20 billion in value-added agri-products by 2005, the value of dairy products will have to double.

In the Works

Examples of approved dairy projects for 1996/97:

- "Commercialization of Milk Protein Genotyping Technology in Alberta," Dr. L. Ozimek, University of Alberta.
- "Reducing Milk Fat Percent and Increasing Milk Protein Yield," Dr. J. Kennelly, University of Alberta.
- "Recombinant Environmental Streptococci Vaccines for Bovine Mastitis," Dr. R. MacLachlan, VIDO (Veterinary Infectious Disease Organization), University of Saskatchewan.
- "Implications of International/ Interprovincial Trade Liberalization for Alberta Dairy Production and Processing," Dr. S. Jeffrey, University of Alberta.
- "An Assessment of the Economic Impact of BST on the Alberta Dairy Sector," Dr. S. Jeffrey, University of Alberta.

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